Assignment 9: Due Dec 2nd, 2019

*** * Please print your assignment and submit it to the lecturer on the due date, thanks for your cooperation.**

1. A new fertilizer has been developed to increase the yield on crops, and the makers of the fertilizer want to better understand which of the three formulations (blends) of this fertilizer are most effective for wheat, corn, soy beans and rice (crops). They test each of the three blends on five samples of each of the four types of crops. Run an F-test to test the effect of fertilizer, crops and their interaction.

Fertilizer	Crop			
	Wheat	Corn	Soy	Rice
Blend X	123 156 112 100 168	128 150 174 116 109	166 178 187 153 195	151 125 117 155 158
Blend Y	135 130 176 120 155	175 `32 `20 `87 184	140 145 159 131 126	167 183 142 167 168
Blend Z	156 180 147 146 190	186 138 178 176 187	185 206 188 165 185	175 173 154 191 169

2. A common symptom of otitis media in young children is the prolonged presence of fluid in the middle ear, known as middle-ear effusion. The presence of fluid may result in temporary hearing loss and interfere with normal learning skills in the first 2 years of life. One hypothesis is that babies who are breastfed for at least 1 month build up some immunity against the effects of the infection and have less prolonged effusion than do bottle-fed babies. A small study of 24 pairs of babies is set up, in which the babies are matched on a one-to-one basis according to age, sex, socioeconomic status, and type of medications taken. One member of the matched pair is a breastfed baby, and the other member is a bottle-fed baby. The outcome variable is the duration of middle-ear effusion after the first episode of otitis media. The results are given in the table below.

Pair number	Duration of effusion in breastfed baby (days)	Duration of effusion in bottle-fed baby (days)
1	20	18
2	11	35
3	3	7
4	24	182
5	7	6
6	28	33
7	58	223
8	7	7
9	39	57
10	17	76
11	17	186
12	12	29
13	52	39
14	14	15
15	12	21
16	30	28
17	7	8
18	15	27
19	65	77
20	10	12
21	7	8
22	19	16
23	34	28
24	25	20

(a) Why might a nonparametric test be useful in testing the hypotheses?

(b) Test the hypothesis that the duration of effusion is different among breastfed babies than among bottle-fed babies using a nonparametric test.

3. There were 20 patients undergoing abdominal, thoracic, or vascular surgery, who either had documented coronary artery disease or were at high risk for coronary disease. These patients were randomly assigned to receive routine thermal care (hypothermic care, (patients' core temperatures were allowed to decrease to about 34.5°C) or normothermic (patients' core temperatures were maintained at near normal 36.5°C) care. Wound complications were assessed using the ASEPSIS scores for all patients and are listed in the following table. Perform a nonparametric test to see if there is statistically significant difference in average ASEPSIS scores between patients from Hypothermic and Normothermic care, at 5% level of significance.

Normothermic Care	Hypothermic Care
11	16
9	7
4	18
9	19
10	15
12	12
9	11
14	12
3	19
5	9

4. Suppose we have data on vitamin E intake (IU/day)(from both diet and vitamin supplements) at baseline in four treatment groups in a clinical trial of nutritional supplements. It is important to establish that the vitamin E intakes of the four treatment groups are comparable at baseline. The data for the first 10 participants in each group are given in the table below.

Baseline vitamin E intake by treatment group in a clinical trial of nutritional supplements

Subject	Group 1	Group 2	Group 3	Group 4
1	5.92	5.22	4.33	5.37
2	8.24	3.29	16.31	6.39
3	7.27	3.67	6.19	4.90
4	6.24	4.29	7.95	4.75
5	5.21	109.17	4.02	3.07
6	8.25	5.82	6.12	10.64
7	8.33	7.17	5.60	6.50
8	4.12	4.42	12.20	159.90
9	6.27	5.29	3.33	6.00
10	5.38	55.99	7.33	7.31

(a) Why might a nonparametric analysis of these data be useful?

(b) Perform the Kruskal-Wallis test to assess whether there are any significant overall group differences in vitamin E intake.